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13. ABSTRACT (Maximum 200 words)  With the assistance of funding from the Army Research Office we were able to attract outstanding speakers and discussion leaders from academe, industry and government. The program started with two presentations on the chemistry of organic high temperature matrices for composites which were followed later in the week by two presentations on the selection and behavior of ceramic matrices and composites. A unique aspect of this conference was a strong emphasis on methods for characterizing composites through presentations on stereoinaging, tunneling microscopy and a variety of spectroscopic techniques. The bulk of the conference dealt with fracture, toughening and lifetime prediction over a range of composites from the traditional fiber reinforced materials to micro and molecular composites. A final pair of presentations on process engineering and analysis completed our broad range of coverage on the chemistry, physics and engineering of composite materials.				
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Final Report

to

U.S. Army Research Office  
P. O. Box 12211  
Research Triangle Park, N.C. 27709-2211

for

R&D Project: 1L161102BH57-04 - Materials

from

Gordon Research Conferences  
Gordon Research Center  
University of Rhode Island  
Kingston, Rhode Island 02881-0801

Submitted by:

A. T. DiBenedetto  
Chairman, 1990 GRC-Composites

Date:

January 26, 1990

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R&D Project: 1L161102BH57-04 - Materials

The 1990 Gordon Research Conference on Composites  
January 2-6, 1990  
Ventura, California

The program for the 1990 Gordon Research Conference on Composites was highly successful, following closely the format suggested in our original grant proposal. The final SPEAKERS PROGRAM and POSTER SESSION programs are attached.

With the assistance of funding from the Army Research Office we were able to attract outstanding speakers and discussion leaders from academe, industry and government. The program started with two presentations on the chemistry of organic high temperature matrices for composites which were followed later in the week by two presentations on the selection and behavior of ceramic matrices and composites. A unique aspect of this conference was a strong emphasis on methods for characterizing composites through presentations on stereoimaging, tunneling microscopy and a variety of spectroscopic techniques. The bulk of the conference dealt with fracture, toughening and lifetime prediction over a range of composites from the traditional fiber reinforced materials to micro and molecular composites. A final pair of presentations on process engineering and analysis completed our broad range of coverage on the chemistry, physics and engineering of composite materials.

The poster session was particularly interesting, covering a wide range of topics with presentations of a very high caliber. This session provided an opportunity for a number of young scientists to participate in a Gordon Conference for the first time and added a dimension to the meeting which was well received by the other participants.

There were 94 registrants attending technical sessions, 32 (34.1%) university faculty, 42 (44.7%) industry scientists, 8 (8.5%) from government laboratories and 12 (12.7%) postdoctoral and PhD guests. Of the 94 participants 11 were foreign visitors (not counting the postdoctoral and PhD invitees).

Among the purposes of the supplementary funding were the ability to invite foreign speakers for the main program and young scientists to present their work in the poster session. The breakdown of expenditures for travel and registration is as follows:

Principal U.S. Participants	\$ 1,480
Foreign Speakers	\$ 1,765
Young Scientists with Posters	<u>\$ 1,955</u>
	\$ 5,200

The assistance of the Army Research Office in the execution of a successful conference is greatly appreciated.

GORDON RESEARCH CONFERENCES  
COMPOSITES

January 2-6, 1990

Doubletree Hotel, Ventura, CA

A. T. DiBenedetto, Chairman

A. Gent, Vice-Chairman

We gratefully acknowledge the support of the U.S. Army Research Office and the Materials Division of the Office of Naval Research/(DARPA).

Tuesday, 9:00 A.M.

Discussion Leader: Dan Scola, United Technologies Research Center

James McGrath  
VPI

Toughened Thermoplastic and Thermoset Matrices For Composites

Dan Scola  
UTRC

Some Aspects of Polyimide Process Chemistry

Tuesday, 7:30 P.M.

Discussion Leader: Jack L. Koenig, Case Western Reserve

James Lankford  
Southwest Res. Inst.

Micromechanics Studies Using Stereoimaging, STM and Other Techniques

Steven Suib  
U. of Connecticut

Spectroscopic Methods of Characterizing Ceramic Composite Interfaces

Wednesday, 9:00 A.M.

Discussion Leader: John Halpin, Airforce Materials Laboratory

Eric Baer  
Case-Western Reserve

Failure and Fracture of Polymer Multilayer Composites

Albert Yee  
U. of Michigan

Toughening Concepts in Composite Materials

W. Michael Sanford  
DuPont

Thermoplastic Molecular Composites

Wednesday, 7:30 P.M.

Discussion Leader: Richard Farris, University of Massachusetts

Charles Tucker  
U. of Illinois

Flow Problems in Composite Materials Processing

Michael Folkes  
Brunel Univ.

Short Fibre Versus In-situ Fabricated Composites

Thursday, 9:00 A.M.      Discussion Leader: Alan Gent, University of Akron

George Sendeckyj  
Wright Research &  
Development Center

Life Prediction For Resin Matrix Composites

Jan Achenbach  
Northwestern Univ.

Quantitative Non-Destructive Evaluation of  
Fiber Reinforced Composites

Ronald Kander  
DuPont

Strain Rate Effect on Damage Mechanisms in an  
Orthotropic Glass/Polypropylene Composite

Thursday, 4:00-6:00 P.M.      Poster Session

Thursday, 7:30 P.M.      Discussion Leader: Moshe Narkis, Technion, Israel

Roger Porter  
U. of Massachusetts

Adsorption of Thermoplastic Matrices on Continuous  
Fiber Composites

Ron Allred  
PDA

Plasma Treatments of Carbon Fibers

Friday, 9:00 A.M.      Discussion Leader: Sandy Sternstein, RPI

Judd Diefendorf  
RPI

Selection, Fabrication and Property Analysis of  
Ceramic Composite Systems

David Marshall  
Rockwell Science  
Center

Relation Between Structure and Properties of  
Ceramic Composites

Friday, 7:00 P.M.      Business Meeting

Friday, 7:30 P.M.      Panel Discussion  
Fracture Toughness Testing of Fiber Composite Laminates

Walter Bradley, Texas A&M, Presiding  
J. G. Williams, Imperial College and Peter Davies,  
Ecole Polytech. de Lausanne, Discussants

Saturday, 9:00 A.M.      Discussion Leader: Luigi Nicolais, University of Naples

Douglas Cairns  
Hercules

Multidimensional Process Modeling of Thermoset Resin  
Curing in Fiber Reinforced Composites

Robert Powell  
U. of California-Davis

Impregnation of Fiber Bundles

1990 Gordon Research Conference on Composites

POSTER SESSION

Provisional Program (as at December 27, 1989)

1. S. Dirlikov, Eastern Michigan University:

PROPARGYL-TERMINATED RESINS

2. E. Bayramli and R. L. Powell, University of California, Davis, and D. Chan, Hexcel Corporation:

SURFACE CHARACTERIZATION OF INTERMEDIATE MODULUS GRAPHITE FIBERS VIA SURFACE FREE ENERGY MEASUREMENT AND ESCA

3. H. D. Wagner, E. Wiesel and M. E. Gallis, Weizmann Institute, Israel:

SPREADING OF LIQUID DROPLETS ON CYLINDRICAL SURFACES:  
ACCURATE DETERMINATION OF CONTACT ANGLE

4. H.D . Wagner and A. Eitan, Weizmann Institute, Israel:

INTERPRETATION OF THE FRAGMENTATION PHENOMENON IN SINGLE-FILAMENT COMPOSITE EXPERIMENT

5. A. N. Gent and G. L. Liu, University of Akron:

TESTS OF ADHESION STRENGTH IN MODEL FIBER COMPOSITES

6. J. A. Nairn and S. Liu, University of Utah:

FRACTURE MECHANICS ANALYSIS OF COMPOSITE MICROCRACKING:  
EXPERIMENTAL RESULTS

7. G. S. Bennett and R. J. Farris, University of Massachusetts:

THERMAL, MECHANICAL AND MORPHOLOGICAL PROPERTIES OF AMINE-TERMINATED POLY(ARYL-ETHERKETONE)/EPOXY-AMINE RESIN SYSTEMS

8. A. R. Plepys and R. J. Farris, University of Massachusetts:

EVOLUTION OF RESIDUAL STRESSES IN THREE-DimensionALLY  
CONSTRAINED EPOXY RESINS

9. J. A. Gomez, A. T. DiBenedetto, and S. J. Huang, University of Connecticut:

OLIGOMERIC TITANATES AS COUPLING AGENTS FOR FIBER  
REINFORCED THERMOPLASTICS

10. L. Bui, A. N. Gent and Y.-C. Hwang, University of Akron:  
FEM ANALYSIS OF PARTICLE-FILLED COMPOSITES
11. W. Lee, A. T. DiBenedetto and J. M. Gromek, University of Connecticut:  
PROCESSING OF THERMOTROPIC LIQUID CRYSTALS AND THEIR BLENDS
12. C. Chmielewski, C. A. Petty and K. Jarayaman, Michigan State University:  
CROSSFLOW PERMEATION THROUGH ARRAYS OF CYLINDERS
13. R. J. Amundsen and A. F. Yee, University of Michigan:  
HIGH SPEED IN-SITU COMPOSITE FABRICATION TECHNIQUES AND  
MICROSTRUCTURAL ANALYSIS
14. H. J. Sue and A. F. Yee, University of Michigan:  
FAILURE MECHANISM IN A MULTI-PHASE ALLOY OF NYLON 6,6/PP0  
UNDER LOW TEMPERATURE AND HIGH RATE CONDITIONS
15. B. C. Benicewicz and A. E. Hoyt, Los Alamos National Laboratory:  
RIGID ROD MOLECULES AS LIQUID CRYSTAL THERMOSETS
16. C. R. Corleto and W. Bradley, Texas A&M University:  
MODE II DELAMINATION FRACTURE CHARACTERIZATION OF FIBER  
REINFORCED COMPOSITES
17. E. Lara-Curzio and S. S. Sternstein, R.P.I.:  
TIME-DEPENDENT HIGH-TEMPERATURE DEFORMATION OF SiC FIBERS
18. J.-L. Liang and J. P. Bell, University of Connecticut and D. A. Scola,  
United Technologies Research Center:  
ELECTROPOLYMERIZED N-SUBSTITUTED POLYMETHACRYLAMIDE MATRIX  
FOR GRAPHITE FIBER COMPOSITES
19. E. W. Liang, University of Illinois (Urbana-Champaign):  
COMPRESSION MOLD FILLING SIMULATION FOR THICK AND NON-PLANAR  
PARTS
20. S.-Y. Gweon, University of Utah:  
LOW-VELOCITY IMPACT DAMAGE IN CARBON FIBER COMPOSITES

## GORDON RESEARCH CONFERENCES

## COMPOSITES

JANUARY 2-6, 1990

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